As soon as the tuberculous patient has been treated with increasing doses for so long that the point is reached when his reaction is as feeble as that of a non-tuberculous patient, then it may be assumed that all tuberculous tissue is destroyed. And then the treatment will only have to be continued by slowly increasing doses and with interruptions, in order that the patient may be protected from fresh infection while bacilli are still present in the organism.

Whether this conception, and the inferences that follow from it, be correct, the future must show. They were conclusive as far as I am concerned in determining the mode of treatment by the remedy, which, in our investigations, took the following form.

The Treatment Applied to Lupus.

To begin with the simplest case, lupus; in nearly every one of these cases I injected the full dose of 0·01 cubic centimetre from the first. I then allowed the reaction to come to an end entirely, and then, after a week or two, again injected 0·01 cubic centimetre, continuing in the same way until the reaction became weaker and weaker, and then ceased. In two cases of facial lupus the lupus spots were thus brought to complete cicatrization by three or four injections; the other lupus cases improved in proportion to the duration of treatment. All these patients had been sufferers for many years, having been previously treated unsuccessfully by various therapeutic methods.

The Treatment Applied to Tuberculosis of the Bones and Joints.

Glandular, bone, and joint tuberculosis was similarly treated, large doses at long intervals being made use of; the result was the same as in the lupus cases—a speedy cure in recent and slight cases, slow improvement in severe cases.

The Treatment applied to Phthisis.

Circumstances were somewhat different in phthisical patients, who constituted the largest number of our patients. Patients with decided pulmonary tuberculosis are much more sensitive to the remedy than those with surgical tuberculous affections. We were obliged to lower the dose for the phthisical patients, and found that they almost all reacted strongly to 0·002 cubic centimetre, and even to 0·001 cubic centimetre. From this first small dose it became possible to rise more or less quickly to the same amount as is well borne by other patients.

Our course was generally as follows:—An injection of 0·001 cubic centimetre was first given to the phthisical patient; on this a rise of temperature followed, the same dose being repeated once a day, until no reaction could be observed. We then rose to 0·02 cubic centimetre, until this was borne without reaction; and so on, rising by 0·001, or at most 0·002, to 0·01 cubic centimetre and more. This mild course seemed to me imperative in cases where there was great debility. By this mode of treatment the patient can be brought to bear large doses of the remedy with scarcely a rise of temperature. The patients of greater strength were treated from the first, partly with larger doses, partly with rapidly repeated doses. Here it seemed that the beneficial results were more quickly obtained.

The action of the remedy in cases of phthisis generally showed itself as follows:—Cough and expectoration generally increased a little after the first injection, then grew less and less, and in the most favourable cases entirely disappeared; the expectoration also lost its purulent character, and became mucous.

As a rule the number of bacilli only decreased when the expectoration began to present a mucous appearance; they then from time to time disappeared entirely, but were again observed occasionally until expectoration ceased completely. Simultaneously the night sweats ceased, the patients' appearance improved, and they increased in weight. Within four to six weeks patients under treatment for the first stage of phthisis were all free from every symptom of disease, and might be pronounced cured. Patients with cavities, not yet too highly developed, improved considerably, and were almost cured; only in those whose lungs contained many large cavities could no improvement be proved objectively, though even in these cases the expectoration decreased, and the subjective condition improved. These experiences lead me to suppose that phthisis in the beginning can be cured with certainty by this remedy.[1]

Effect in Advanced Cases of Phthisis.

In part this may be assumed for other cases when not too far advanced; but patients with large cavities, who almost all suffer from complications caused, for instance, by the incursion of other pus-forming micro-organisms into the cavities, or by incurable pathological changes in other organs, will probably only obtain lasting benefit from the remedy in exceptional cases. Even such patients, however, were benefited for a time. This seems to prove that, in their cases, too, the original tuberculous disease is influenced by the remedy in the same manner as in the other cases, but that we are unable to remove the necrotic masses of tissue with the secondary suppuration processes.

The thought suggests itself involuntarily that relief might possibly be brought to many of these severely afflicted patients by a combination of this new therapeutic method with surgical operations (such as the operation for empyema), or with other curative methods. And here I would earnestly warn people against a conventional and indiscriminate application of the remedy in all cases of tuberculosis. The treatment will probably be quite simple in cases where the beginning of phthisis and simple surgical cases are concerned; but in all other forms of tuberculosis medical art must have full sway by careful individualization, and making use of all other auxiliary methods to assist the action of the remedy. In many cases I had the decided impression that the careful nursing bestowed on the patient had a considerable influence on the result of the treatment, and I am in favour of applying the remedy in proper sanatoria as opposed to treatment at home and in the out-patient room. How far the methods of treatment already recognized as curative—such as mountain climate, fresh-air treatment, special diet, &c.—may be profitably combined with the new treatment cannot yet be definitely stated, but I believe that these therapeutic methods will also be highly advantageous when combined with the new treatment in many cases, especially in the convalescent stage.[1] The most important point to be observed in the new treatment is its early application. The proper subjects for treatment are patients in the initial stage of phthisis, for in them the curative action can be most fully shown, and for this reason, too, it cannot be too seriously pointed out that practitioners must in future be more than ever alive to the importance of diagnosing phthisis in as early a stage as possible. Up to the present the proof of tubercle bacilli in the sputum was considered more as an interesting point of secondary importance, which, though it may render diagnosis more certain, could not help the patient in any way, and which, in consequence, was often neglected. This I have lately repeatedly had occasion to observe in numerous cases of phthisis which had generally gone through the hands of several doctors without any examination of the sputum having been made. In future this must be changed. A doctor who shall neglect to diagnose phthisis in its earlier stage by all methods at his command, especially by examining the sputum, will be guilty of the most serious neglect of his patient, whose life may depend on this diagnosis, and the specific treatment at once applied in consequence thereof. In doubtful cases medical practitioners must make sure of the presence or absence of tuberculosis, and then only the new therapeutic method will become a blessing to suffering humanity, when all cases of tuberculosis are treated in their earliest stage, and we no longer meet with neglected serious cases forming an inextinguishable source of fresh infections. Finally, I would remark, that I have purposely omitted statistical accounts and descriptions of individual cases, because the medical men who furnished us with patients for our investigations have themselves decided to publish the description of their cases, and I wish my account to be as objective as possible, leaving to them all that is purely personal.

ON THE INCUBATION OF SNAKES' EGGS.[2]

MOST Reptilia are oviparous, but certain of the Lacertilians, and many Ophidians, especially vipers and sea-snakes, are ovo-viviparous—that is to say, the eggs are hatched within the mother, or, as sometimes occurs, during the process of parturition. This is the case with the English viper.

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[1] This sentence requires limitation in so far as at present no conclusive experiences can possibly be brought forward to prove whether the cure is lasting. Relapses naturally may occur; but it can be assumed that they may be cured as easily and quickly as the first attack. On the other hand, it seems possible that, as in other infectious diseases, patients once cured may retain their immunity. This, too, must, for the present, remain an open question.

[1] As regards tuberculosis of brain, larynx, and miliary tuberculosis, we had too little material at our disposal to gain proper experience.

[2] By Walter K. Sibley, M.B., B.C., B.A. Camb., Assistant Physician to the North-West London Hospital. (Substance of a paper read before the Biological Section of the British Association at Leeds, September 1890.)

There has not been much written on the hatching of snakes' eggs. Almost the first literature of the subject appears to be some observations of M. Valenciennes made in 1841, at the Jardin des Plantes in Paris, and published in the *Comptes rendus*, on a Python (*Python bivittatus*) which was about 10 feet long. This reptile, in the beginning of May, deposited fifteen eggs: it coiled itself up over them for fifty-six days, after which period eight of the eggs hatched, and the young snakes came out, each measuring about half a metre in length. With regard to the temperature of the mother, he says, there was a marked increase of temperature during the whole period of incubation, which was highest at the commencement, and gradually diminished till the close.

In 1862, Sclater, in the Proceedings of the Zoological Society, described a Python (*Python sebæ*) which incubated her eggs, one hundred in number, for eighty-two days, at which period they were removed, none having hatched, and on examination it was found that five or six contained embryos. With regard to the temperature, he states that, in every observation, the female was several degrees warmer than the male; both being kept under similar conditions. Double observations were always made, one with the thermometer placed on the surface of the body, and the other by placing it between the folds. The differences in the temperature of the snake's body and of the surrounding air was higher by from 2°·8 to 12°·4 F., taken on the surface of the animal, and from 6°·8 to 20°·0 F., taken between the folds of the skin.

In the same year Colonel Abbott recorded that he had in his possession in India a female boa, which incubated her eggs, forty-eight in number, for three months, at the end of which period, on opening one of the shells, a live fully-formed young one was found.

In 1880, Forbes carried on some investigations with the eggs of *Python molurus* in the Zoological Society's Gardens. The snake was some 12 feet long, and on the night of June 5–6, deposited about twenty eggs, and then coiled herself around them, almost completely concealing them from view. She continued to cover the eggs for a period of six weeks, never eating during the whole time, and apparently only once leaving the eggs for a few hours one morning early in July.

On July 18—that is, forty-three days after—the eggs revealing evidences of decomposition they were removed, and one or two were found to contain embryos.

From June 14—that is, nine days after the eggs were laid—till they were removed on July 18, careful temperatures were taken every two or three days between the hours of 12 and 2 p.m. The temperature was taken both of the incubating female and also of the male, which was kept under similar circumstances in the next cage, the same methods being employed as in Sclater's experiments just described. The temperature was always found to be highest when that of the air in the cages was also highest. The temperature of the female was higher and more constant than that of the male. The greatest difference between that of the snake and that of the air was 8°·3 F. for the male, and 9°·6 F. for the female, taken on the surface; and 11°·6 F. for the male, and 16°·7 F. for the female, taken between the coils of the skin. It will be noticed that Valenciennes, who kept his snakes much colder,[1] records a difference of as much as 38°·7 F. (21°·5 C.), and some of his eggs hatched, which was not the case with Forbes's; also the later observer does not record a steady fall of the temperature throughout the incubation as did the former.

The common English snake (*Natrix torquata*) lays its eggs, varying in number from about fifteen to thirty, principally in manure-heaps, but also in holes and crevices between or under stones. It is usually stated they are laid in the autumn, but I have frequently found them towards the end of July, and one snake I had in confinement laid them as early as the 11th of that month. The shells being very thin and soft they require very delicate handling, the eggs being readily injured.

When laid under stones or in crevices, they are protected from the immediate pressure of the earth, and when deposited in manure which is much bound together by leaves and straw, &c., they are not individually subjected to much pressure. It must also be noticed that the eggs are usually found very close to the surface, and if laid deep in the manure heap, they, as a rule, do not hatch, although if examined late in the season the young snakes are found in them often completely formed, but dead. When first laid, the eggs are swollen out and full, and many or all the eggs are firmly bound together by adhesive medium. The egg-shell, if examined with the microscope, is found to consist of peculiar glistening fibres arranged in many separate layers. Between the outer layers only a small quantity of calcareous matter is present, and these fibres appear to be closely fitted together. There are seen in fresh, or better in specimens hardened in chromic acid, ten or more layers laid very closely one upon the other. The outer layers differ from the others in that they contain many rather club-shaped bodies of very different thicknesses and appearances placed between the other fibres.

The eggs are at first of a whitish straw colour. As time goes on, they become somewhat darker and then of a brown colour, and finally very dark; but these colour changes do not occur evenly over the whole shell, but in patches, and to a very varying extent. At the same time the regular outline is gradually lost, the shell shrivels, loses its original elasticity, and so at this stage impressions made upon the surface remain permanent. The diminution in actual bulk of the egg is probably due to evaporation of water from its substance. It is chiefly the extreme delicacy of the eggs, also the difficulty of keeping them in the requisite amount of moisture, that makes them so very hard to hatch artificially. But all these difficulties may with care be overcome, as I will proceed to describe.

On July 22, 1889, I found, in the manure of a cucumber-frame in Surrey, some seventy snakes' eggs in two masses, close together, and probably deposited by at least two snakes. The eggs were apparently of recent date, but showed great differences in the stage of their development—even those which were clearly laid by the same female. After removing some eggs for immediate examination, the rest were covered up again by the manure and left.

On September 8 they were again uncovered, and some were removed and taken to London. One of the eggs being opened at this period, the embryo snake was fairly well formed, and movements were visible but feeble. The eggs were brought to London on September 8, and on the 9th some were placed in an ordinary bacteriological incubator regulated for a temperature of 32° C. (89°·6 F.). The eggs were placed in open glass dishes with a small quantity of dung laid both at the bottom of the dish and also partially covering the eggs. Some of the dishes were left open, and others were protected by a piece of glass loosely laid over, but allowing the air to freely circulate, and were kept perpetually moist by cotton wool soaked in water. At the same time some eggs were placed under similar conditions in the atmosphere of the room, the temperature of which was maintained at about 17° C. (62°·6 F.). On September 17, the incubator leaked and had to be repaired, and during this period the eggs from it were left in the room temperature—namely, about 17° C.; the eggs being replaced in the incubator again on September 25.

On September 27, two of the eggs which had been kept all the time in the room temperature, showed signs of hatching—that is, the heads of the young snakes had broken through the shells, temperature 19° C. (66°·2 F.). These were noticed at 10 p.m. The next morning at 10 a.m., the hatching eggs presented the same appearances—that is, the heads only were out of the shells. The dish with these eggs was then placed on the top of the incubator at about a temperature of 24° C. (75° F.). At 1 p.m. the condition was unchanged, and at 10 p.m. both snakes were quite out of their shells.

On the same day, that is, the 28th, at 10 p.m., the head of one of the snakes inside the incubator was seen; at 10 the next morning this snake was quite free from its shell.

During the next few days several more eggs hatched, both those inside and those outside the incubator.

Some eggs, which were kept in a tin of manure in the room atmosphere of about 18° (64°·4 F.) since September 8, were on the 25th placed outside the window. During the night the temperature registered a minimum of 1°·5 C. (35° F.). On the 26th, they were brought inside again, and on the 27th they were placed in a temperature of 26° C. (78°·8 F.). In the course of time some of these eggs hatched with the others. The eggs in the incubator were placed at first on their sides, but on the 28th some were placed on their ends, and in both positions they appeared to hatch equally well.

The period of incubation of the eggs was thus about seventy-five to ninety days; the python, as described by Valenciennes, being fifty-six days. It was noticed that many days often elapsed between the hatching of the eggs of the same lot—even those kept under similar circumstances. The differences in the actual stage of development of the eggs when first laid may possibly explain the apparent differences in the dates of hatching.

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[1] The extreme temperatures of the air recorded by Valenciennes, who took his observations when the cages were coldest, *i.e.* before the fresh hot water was put in, were 17°, and 23° C. (62°·6 and 73°·4 F.) respectively. The temperature of the two cages in which the animals were kept was only on three occasions less than the highest in Valenciennes' series.

On July 11, 1890, a snake I had in confinement laid eighteen eggs. Some of these were placed at a temperature of 16°–20° C. (61°–68° F.): at the end of October, not being hatched, they were opened, and found to contain fully-formed young ones, but these were all dead. Other eggs from the same lot, which was laid on July 11, were sent into the country and placed in a manure-heap; on September 9, an egg being opened, the embryo snake was nearly formed, but there were no movements visible; on September 24 these eggs began to hatch—that is, after an incubation of seventy-five days.

From the first set of experiments it did not appear that the actual temperature influences to any great degree the period of incubation, or at least not after the first few weeks. (In the cases described it would appear that the eggs had been deposited some seven weeks before they were removed, and then kept artificially from three weeks to a month before they hatched.) Also, that exposure to the atmosphere does not destroy their vitality, provided they are kept fairly moist, some having hatched after several days' full exposure to the air of the room; and that they may be exposed to rather low temperatures, at least for a few hours, and yet finally hatch. As might be expected, some eggs which were placed in small glass pots and hermetically sealed did not hatch.

The process of hatching was very interesting to watch. At first a slit appeared in the uppermost part of the egg, whether the egg was placed on the side or on one end; most usually the slit rapidly became a V-shaped one, which in shape and position corresponded to the snout of the young reptile—that is to say, the apex of the V corresponding to the tip of the lower jaw. The snakes would often remain for some hours in this position, with just their snouts out, and, when disturbed, would withdraw these into the shells again. In a state of nature I have seen them when completely out of the shell, retreat into it again when disturbed. When first out of the shell, the young snakes were very smooth and velvety to the touch; there was usually some opacity about the cornea, which disappeared after a few hours; the yellow ring on the neck was well marked from the very first. They were about 15 cm. (6 inches) in length, and weighed about 3 grammes (45 grains); the eggs themselves weighed about 6 grammes (80 to 90 grains). One cast its skin within a few days after birth, and died. Occasionally they were hatched with the yolk-sac adherent, and in these instances always died. From the first the snakes were very lively, and within a very few days produced the characteristic hissing noise when provoked.

Many problems in connection with the subject of the incubation of eggs might be mentioned. It would be interesting to ascertain definitely what are the maximum and minimum temperatures at which the vital processes can take place in an incubating egg. There is probably an optimal temperature, or one at which the process proceeds most rapidly or most favourably. So also it might be asked, Is the optimal temperature the same for all kinds of eggs—those, for instance, of various forms of birds and those of snakes and lizards? Is the increase of temperature, both of the incubating bird and of the incubating python, essential to the hatching of the eggs? What is the reason of the differences in the incubation periods between different birds? Why, for instance, do pigeons' eggs hatch in fourteen days, hens' three weeks, turkeys' a month, and swans' six weeks?

We know that if a hen's egg be maintained for some twenty-one days at a temperature of about 40° C. it will hatch; but I am not aware of any experiments to ascertain if they will hatch at a temperature considerably under or much over this, and what is the minimum temperature at which they will hatch at all? In the case of many of the micro-organisms, bacteriologists have found the actual limits of temperature within which the various species grow, and also that most of them have an optimal temperature—that is, one at which these lowest forms of vegetable life grow most luxuriantly.

Literature.—Valenciennes, *Comptes rendus de l'Académie des Sciences*, 1841; Sclater, Proceedings of the Zoological Society, London, 1862; Abbott, Proceedings of the Zoological Society, London, 1862; Lataste Fernand, Paris, 1877; Forbes, Proceedings of the Zoological Society, London, 1880; Fisher, *Der Zoolog. Garten*, Bd. 26, 1886.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Among the lectures which are being delivered this term, we notice the following:—Electricity, Prof. Clifton; Physical Optics, Mr. Walker; Ureas and Uric Acid, Prof. Odling; Surfaces of the Second Order, Prof. Sylvester; Disturbed Elliptic Motion, Prof. Pritchard.

In the Morphological Department Prof. Ray Lankester is giving a general course on Animal Morphology, and Mr. Minchin, who has been appointed Junior Demonstrator, is lecturing on the Porifera.

The arrangements for the instruction of medical students in physiology have been considerably improved.

The Burdett-Coutts Geological Scholarship has been awarded to Mr. F. W. Howard, of Balliol.

In the Report of the Visitors of the University Observatory it is stated that Prof. Pritchard will shortly publish an enlargement of his lectures on Disturbed Elliptic Motion.

The following examiners have been appointed for next year:—Physics, Mr. Baynes and Mr. H. G. Madan; Chemistry, Prof. Tilden; Animal Morphology, Mr. Poulton and Mr. Bourne; Physiology, Mr. F. Gotch.

The statute respecting the admission of women to examinations in medicine, which has formed the subject of a good deal of controversy, has been rejected in Congregation by 79 votes to 75.

SCIENTIFIC SERIALS.

THE *Quarterly Journal of Microscopical Science* for August contains:—On the origin of vertebrates from Arachnids, by W. Patten (plates xxiii. and xxiv.). As a full description of the author's observations could not be published without considerable delay in this article of sixty pages, he gives a short account of the facts bearing directly on the subject, and at the same time presents his theoretical conclusions. Recognizing the "Annelid theory" as sterile, the author thinks that since vertebrate morphology reflects, as an ancestral image only, the dim outlines of a segmented animal, but still not less a vertebrate than any now living, it is clear that the problem must be solved, if at all, by the discovery of some form in which the specialization of the vertebrate *head* is already foreshadowed. While, since of all invertebrates, concentration and specialization of head segments is greatest in the Arachnids, it is in these, on *a priori* grounds, that we should expect to find traces of the characteristic features of the vertebrate head. Finding, from time to time, confirmation of this preconceived idea, as the unexpected complexity of the Arachnid cephalothorax revealed itself, he feels justified in formulating a theory that *Vertebrates are derived from the Arachnids.*—On the origin of vertebrates from a Crustacean-like ancestor, by W. H. Gaskell, F.R.S. (plates xxv. to xxviii.). This paper is but chapter one of a very important memoir, which approaches the subject of the ancestry of the vertebrates from a different standpoint from that of Dr. Patten. In previous papers the author had pointed out that the vertebrate nervous system is composed of nervous material grouped around a central tube which was originally the alimentary canal of the invertebrate from which the vertebrate arose, and that the physiology and anatomy of this system both best fit in with the assumption that the invertebrate ancestor was of the Crustacean, or at least of a proto-Crustacean type. In both these papers the author promised to point out the confirmation of this theory, which is afforded by the study of the lowest vertebrate nervous system, viz. that of the Ammocœtes form of Petromyzon. This promise he redeems in this paper, in which, to bring out as prominently as possible the theory, he discusses the nervous system of the Ammocœtes in terms of the Crustacean. Taking separately the prominent features of the alimentary canal and central nervous system of a Crustacean-like animal, he indicates how each one exists in the nervous system of the Ammocœtes. In a second chapter it will be pointed out how the present alimentary canal arose by the prolongation of a respiratory chamber.—On the development of the atrial chamber of Amphioxus, by E. Ray Lankester, F.R.S., and Arthur Willey (plates xxix. to xxxii.). The period of development was that before Hatschek's well-known work stops short. Series of sections were prepared in order to ascertain the mode in which the atrial chamber takes its origin, and the subsequent history of the gill-slits, viz. as to how the slits on the left side of